

VIA EFS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Patent Application of:	:	
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	:	
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Title: Alloy Type Thermal Fuse and Material for a Thermal Fuse Element	:	

**ON APPEAL FROM THE PRIMARY EXAMINER TO THE BOARD OF PATENT
APPEALS AND INTERFERENCES**

APPELLANT'S BRIEF UNDER 37 C.F.R. 41.37

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I. REAL PARTY IN INTEREST

This application is assigned to Uchihashi Estec Co., Ltd. of Osaki-shi, Japan, by an Assignment recorded on September 3, 2003, at Reel No. 014479, Frame 0806. Accordingly, Uchihashi Estec Co., Ltd is the real party in interest.

II. RELATED APPEALS AND INTERFERENCES

Appellant, his Assignee and his legal representatives are unaware of the existence of any related appeals and/or interferences that will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 1-2 are canceled.

Claims 3-58 are pending in the instant application on appeal.

Claims 19-22 and 39-58 are withdrawn from consideration as non-elected species.

Claims 3-18 and 23-38 stand finally rejected as discussed below and are the subject of the instant appeal. The complete text of claims 3-18 and 23-38, as pending, is attached hereto as Appendix A.

IV. STATUS OF AMENDMENTS

All amendments filed in this application have been entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The claimed invention relates to alloy type thermal fuses and materials for thermal fuse elements (see, Appellant's Specification ("Spec"), ¶ [0001]). As recited in claim 3, these alloy type thermal fuses and materials contain particular ternary alloy compositions having more than 46% to 70% Sn, 18% to less than 48% In, and 1% to less than 12% Bi, all percentages being by weight (Spec., ¶ [0012]). In one embodiment, as recited in claim 4, 100 weight parts of this alloy composition are combined with 0.1 to 3.5 weight parts of Ag, Au, Cu, Ni, Pd, Pt, Sb, Ga, and/or Ge. As recited in claim 3, the alloy compositions do not contain any elements whose use is prohibited due to harmful effects on living bodies (Spec., ¶ [0004]). The thermal fuses

according to the presently claimed invention thus achieve the goal of environmental conservation by protecting both individuals involved in the manufacturing of the thermal fuses and the end-users who handle them.

Alloy type thermal fuses and fuse elements having the claimed elemental compositions were developed by Appellant as a result of intensive study in order to provide a fuse having a narrow operating temperature range and excellent overload and dielectric breakdown characteristics (Spec., ¶ [0026]). Alloy type thermal fuses according to the invention may have the fuse element connected between lead conductors and optionally sandwiched between insulating films. In one embodiment, at least a portion of each lead conductor bonded to the fuse element is covered with a Sn or Ag film (Spec., ¶¶ [0017] and [0022]).

In fuse elements having alloy compositions with a solid-liquid coexisting region (between the solidus and liquidus temperature), there is a possibility that the fuse element will be fused off at an uncertain temperature in this region. A wide coexisting region thus results in a wide operating temperature range of the fuse. Consequently, in order to reduce this dispersion of operating temperature, an alloy having a narrow solid-liquid coexistence region, and ideally a eutectic composition, may be utilized so that the fuse element fuses off at approximately the liquidus temperature (which is equal to the solidus temperature in a eutectic composition) (Spec., ¶ [0003]).

A variety of ternary Sn-In-Bi alloys are known. As shown in the liquidus projection diagram in Attached Appendix B (previously filed with the Request for Reconsideration dated December 21, 2006), these alloys have a binary eutectic point at 52In-48Sn (point E1) and a ternary eutectic point (point E2) at 21Sn-48In-31Bi. The binary eutectic curve, which elongates from the binary eutectic point toward the ternary eutectic point, passes through a region having 24-47% Sn, 50-47% In, and 0-28% Bi (Spec., ¶ [0006]). Alloy compositions in regions separated from the binary eutectic curve have wider solid-liquid coexistence regions, which may possibly widen an indefinite region of temperatures at which the fuse element fuses off and also increase the dispersion of the operating temperature of the thermal fuse. Accordingly, these regions have not traditionally been investigated for suppressing the dispersion of operating temperature range by narrowing the solid-liquid coexistence region.

However, by studying a variety of Bi-Sn-In alloys having different compositions and measuring the DCS (differential scanning calorimetry) profiles thereof, Appellant has

surprisingly found that when an alloy composition in a specific region which is separated from the binary eutectic curve is used as a fuse element, the resulting fuse element can be concentrically fused off in the vicinity of the maximum endothermic peak. Excellent overload and dielectric breakdown characteristics are thus obtained. Appellant has thus discovered a specific ternary In-Sn-Bi alloy composition, usable for a fuse element, which is suitable for environmental conservation and which provides excellent overload and dielectric breakdown characteristics and a narrow operating temperature range (Spec., ¶ [0026]).

The alloy composition in this region, which is separated from the binary eutectic curve, has a wide liquid coexistence region and a single maximum endothermic peak. Accordingly, the dispersion of the operating temperature of the alloy thermal fuse may be controlled. Moreover, in the alloy composition, the total amount of In and Sn, which have relatively smaller surface tensions, is larger than the amount of Bi, which has a larger surface tension. Therefore, the wettability of the solid-liquid coexisting at the maximum endothermic peak is sufficiently improved, even before the completion of liquification, so that spheroid diversion of the thermal fuse element can be performed in the vicinity of the maximum endothermic peak. Consequently, the dispersion of the operating temperature of the thermal fuse can be reduced (and set to be within a range of $\pm 5^{\circ}\text{C}$). The holding temperature of such thermal fuses (20°C less than the operating temperature) may be less than or equal to the solidus temperature, which is desirable. Further, due to the relatively large percentages of In and Sn in the alloys, fuse elements having sufficient durability to be drawn into thin wires, such as 200 to 300 $\mu\text{m}\phi$, can be achieved (Spec., ¶ [0026]).

Appellant has further found favorable results from utilizing a fuse element having the claimed alloy composition, which is in a range having a wide solid-liquid coexistence region and is separated from the peripheral region of the binary eutectic curve whose solid-liquid coexistence region is narrow. That is, using such an alloy avoids problems resulting from a narrow solid-liquid coexistence region. Namely, the alloy during energizing and temperature rise is instantly changed from solid to liquid, which causes an arc to be easily generated during operation. The resulting local and sudden temperature rise causes vaporization of the flux, and raises the internal pressure or chars the flux. In addition, the molten alloy or the charred flux is intensely scattered. Due to these occurrences, physical destruction, such as crack generation due to local and sudden internal pressure rise, or reconnection between charred flux portions, easily

occurs during operation. Insulation distance is thus shortened and dielectric breakdown results. The wide solid-liquid coexistence region which is exhibited by the present invention will eliminate these undesirable characteristics (Spec., ¶ [0026]).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

- A. Claims 3-10 are rejected under 35 U.S.C. §103(a) as being unpatentable over JP 13-266724 (“JP ‘724”).**
- B. Claims 11-18 are rejected under 35 U.S.C. §103(a) as being unpatentable over JP ‘724 in view of JP 40-3110732 (“JP ‘732”).**
- C. Claims 23-38 are rejected under 35 U.S.C. §103(a) as being unpatentable over JP ‘724 and JP ‘732 in view of GB 2028608 (“GB ‘608”).**

VII. ARGUMENT

A. The Rejection of Claims 3-10 Under 35 U.S.C. §103(a) as Being Unpatentable over JP ‘724 is Improper

1. Disclosure of JP ‘724

JP ‘724 teaches an alloy type thermal fuse having an operation temperature of 95° C to 105°C. The thermal fuse contains a fuse element having an alloy containing 40-46% Sn, 7-12% Bi, and remainder (42-53%) In. In one embodiment, 0.3 to 3.5 weight parts Ag may be combined with 100 weight parts of the In/Sn/Bi composition. JP ‘724 teaches that more preferred is a composition having 43-45% Sn, 7-9% Bi, and remainder (46-50%) In, and exemplary compositions contain 44.5% Sn, 7.4% Bi, and 48.1% In, and 43.0% Sn, 7.1% Bi, and 46.5% In. JP ‘724 teaches that the fuse element may be drawn into a wire having a diameter of 300 μmφ.

2. The Examiner’s Position

In the Office Action mailed September 27, 2006, the Examiner argues that JP ‘724 teaches an alloy type thermal fuse comprising a thermal fuse element having an alloy composition containing 40 to 46 weight % Sn, 7 to 12 weight % Bi, 0.5 to 3.5 weight % Ag, and remainder (42 to 53 weight %) In, which does not necessarily include an element whose use is prohibited due to its harmful effects on a living body. The Examiner argues that the amounts of Bi, Ag, and In overlap with the claimed ranges and that it would have been obvious to one

having ordinary skill in the art to select the desired amounts of Bi, Ag, and In from the JP '724 ranges because JP '724 teaches the same utility as the presently claimed invention.

In the Office Action mailed March 8, 2007, the Examiner argues that due to the closeness of the Sn range disclosed by JP '724 (40 to 46%) to the claimed Sn range (greater than 46% to 70%), one skilled in the art would have expected an amount of Sn slightly greater than 46 weight % to provide the same properties to an alloy as 46 weight % Sn. Citing *Titanium Metals Corp. v. Banner* (778 F.2d 775, 783, 227 USPQ 773, 779 (Fed. Cir. 1985)), the Examiner argues that a *prima facie* case of obviousness typically exists when the ranges of a claimed composition do not overlap with the prior art ranges but are close enough that one skilled in the art would have expected them to have the same properties.

The Examiner takes the position that the alloy of JP '724 would have inevitable impurities, as recited in claims 5 and 6.

Finally, regarding claims 7-10, the Examiner argues in the September 27, 2006 Office Action that JP '724 teaches connecting a fuse element between lead conductors, and that at least a portion of each of the lead conductors is bonded to a fuse element and is covered with a silver paste (i.e., film). Accordingly, the Examiner concludes that the claims are obvious over JP '724.

3. Appellant's Position

a. The Prior Art and Claimed Compositions Do Not Overlap

In the September 27, 2006 Office Action, the Examiner argues that the claimed ranges are overlapping or close to the ranges taught by JP '724. Although the ranges *per se* of two of the three elemental components of the claimed and JP '724 alloy (In and Bi) indeed overlap, the overall alloy compositions do not overlap, as shown in the liquidus projection diagram in Appendix B.

A liquidus projection diagram is a graphical representation of the elemental composition of a ternary alloy which portrays the concentration of all three components at one time. Since the concentrations of all three components are critical, it is easier and more accurate to compare the liquidus projection diagrams than the numerical ranges individually. Thus, a liquidus projection diagram (which graphically represents the compositions) is a proper way to demonstrate that the claimed and prior art compositions as a whole do not overlap.

In a ternary alloy, the concentrations of all of the components are critical. In this case, the concentration of the third elemental component (Sn), which does not overlap with that of JP

‘724, results in an overall composition which does not overlap with the presently claimed alloy. Thus, since the alloy compositions themselves do not overlap, the claimed and prior art alloys would not have been expected to have the same properties.

b. JP ‘724 Teaches Away from the Claimed Invention

In order to arrive at the claimed Sn concentration from that recited in JP ‘724, one skilled in the art, while routinely experimenting with the JP ‘724 alloy, would have had to increase the concentration of Sn from the JP ‘724 range of 40-46% to the claimed range of greater than 46% to 70%. This increase would have necessitated a reduction in the concentration of at least one of the other elements, such as to less than 7% Bi or to less than 42% In (below the recited ranges of Bi and In, respectively). However, JP ‘724 teaches away from reducing the Bi concentration to below 7% (see paragraph [0013] of JP ‘724) by explaining that when the concentration of Bi is less than 7%, it becomes difficult to draw the alloy into a thin wire having a diameter of 350 $\mu\text{m}\phi$. In paragraph [0025], JP ‘724 teaches that an alloy containing 6% Bi could not be drawn into a wire with the desired diameter of 300 $\mu\text{m}\phi$ due to the improper ductility of the material. There is no indication in JP ‘724 that the concentrations of the alloy components could be adjusted in the manner suggested by the Examiner (in order to arrive at the claimed amounts) and still provide similar results (i.e., no reasonable expectation of success has been demonstrated).

As described in Section VII.A.1. above, the broad alloy of JP ‘724 contains 40-46% Sn. However, the preferred alloy composition of JP ‘724 contains 43-45% Sn, and the most preferred alloys of JP ‘724 contain 44.5% Sn (paragraph [0012] of JP ‘724) or 43.0% Sn (Example 2 of JP ‘724), which are in the middle of the JP ‘724 range. Similarly, the preferred In concentrations taught by JP ‘724 is 46 to 50%, most preferably 48.1 % (paragraph [0012] of JP ‘724), which are also in the middle of the JP ‘724 range. There is no suggestion in JP ‘724 that the alloy should be modified to increase the Sn concentration to > 46 to 70% (above the recited range) and thus decrease the Bi or In concentration to below the recited ranges and away from the preferred concentrations. That is, any optimization of these ranges by JP ‘724 points away from modifying the alloy to increase the Sn concentration to greater than 46% (above the recited range). The Examiner has not showed a motivation to vary the prior art concentrations in order to arrive at the claimed concentrations, and thus has not established a *prima facie* case of obviousness.

c. JP ‘724 Fails to Satisfy the Criteria for Establishing Prima Facie Obviousness

To properly satisfy the Examiner's burden in asserting that a *prima facie* case of obviousness exists, based on a single reference, an Examiner must establish that the cited reference: (1) teaches or suggests each and every element of the claimed invention; (2) provides motivation to one of ordinary skill in the art to modify the reference to arrive at the claimed invention (it is NOT sufficient to say that the reference can be modified, without a teaching or suggestion in the prior art as to the desirability of making the modification); and (3) provides one of ordinary skill in the art with a reasonable expectation of success. (See, MPEP § 2143)

i. There Can be No Motivation to Modify to Obtain Negative Results

Since modification of the prior art ranges would have provided an alloy with inferior properties to the original alloy, it would not have been obvious to make such a modification. Rather, such a modification would have been counter-indicated. JP '724 teaches in paragraph [0004] that one of the requirements of a low-melting point fusible alloy is that the solid-liquid coexistence region be narrow. However, modification of the JP '724 alloy to arrive at the claimed alloy would have resulted in a widening of the solid-liquid coexistence region, an undesirable result based on the teaching of JP '724.

As explained above, the suggestion to modify the prior art reference must be found in the prior art, and JP '724 actually teaches away from such a modification, since it would result in an undesirable (to JP '724) widening of the solid-liquid coexistence region. Further, MPEP § 2143.01 states that a proposed modification cannot render the prior art unsatisfactory for its intended purpose. Since modification of the JP '724 alloy to increase the Sn concentration would widen the solid-liquid coexistence region and thus make it unsatisfactory for the intended purpose of JP '724, this proposed modification would not support a *prima facie* case of obviousness.

ii. JP '724 Teaches Away from the Proposed Modification

As stated in MPEP § 2144.03, a *prima facie* case of obviousness may be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. As set forth in Section VII.A.3.b. above, JP '724 clearly teaches away from modification of the ternary alloy to increase the In concentration, which would be necessary to arrive at the present invention.

d. Criticality of Claimed Concentrations Has Been Shown and Rebuts any *Prima Facie* Case of Obviousness

The Examiner cites *Titanium Metals Corp. v. Banner* as teaching that a *prima facie* case of obviousness typically exists when the ranges of a composition are close enough to prior art ranges that one would have expected them to have the same properties. In *Titanium Metals*, the Court indeed held that the claimed alloy containing 0.3% Mo, 0.8% Ni, balance Ti was unpatentable over a reference which disclosed alloys containing 0.25% Mo, 0.75% Ni or 0.31% Mn, 0.94% Ni. The Court held that the compositions were in such close proportion that one would have expected them to have the same properties and no evidence to rebut the prima facie case of obviousness was produced.

MPEP § 2144.05 states that differences in concentrations will not support the patentability of subject matter encompassed by the prior art, unless there is evidence indicating such concentration or temperature is critical. In the present case, the concentrations of the component elements are indeed critical to the resulting alloy. As explained in Section V above (page 3), Appellant has surprisingly found that when an alloy composition in a specific wide solid-liquid coexistence region, which is separated from the binary eutectic curve, is used as the fuse element, the resulting fuse element can be concentrically fused off in the vicinity of the maximum endothermic peak, and excellent overload and dielectric breakdown characteristics are thus obtained. Appellant has thus discovered a specific ternary In-Sn-Bi alloy composition, usable for a fuse element, which is suitable for environmental conservation and which provides excellent overload and dielectric breakdown characteristics, a narrow operating temperature range, and sufficient durability to be drawn into thin wires, such as those having a diameter of 200 to 300 $\mu\text{m}\phi$.

The JP '724 alloy composition is set to include the binary eutectic curve, making the solid-liquid coexistence region narrow and suppressing dispersion of the operating temperature. JP '724 even teaches in paragraph [0004] that it is a requirement of an alloy used as a fuse element of a thermal fuse that the solid-liquid coexistence region be narrow. However, such a prior art alloy cannot avoid the problems which inevitably occur when the solid-liquid coexistence region is narrow, such as the physical destruction described in Section V above (page 3). In contrast, the presently claimed alloy defines a region which is separated from the binary eutectic curve. In the presently claimed alloy composition, the solid-liquid coexistence

region is wide and a single maximum endothermic peak is exhibited. The wide solid-liquid coexistence region overcomes problems caused by a narrow solid-liquid coexistence region, i.e., physical destruction during operating of a fuse, deterioration of insulation resistance, and dielectric breakdown after an operation of a fuse. It is possible to reduce the dispersion of operation temperature of a fuse owing to the single maximum endothermic peak.

Therefore, despite the fact that the Bi and In concentrations in the claimed alloy composition overlap with those taught by JP '724, the ternary alloy compositions are in fact dramatically different in properties due in part to the overlap of the JP '724 alloy with the binary eutectic curve and the separation of the claimed alloy composition from this curve. An alloy composition, such as that taught by JP '724, which falls on the binary eutectic curve, does not exhibit the unexpected properties of the claimed alloy fuses: a narrow operating temperature range and excellent overload and dielectric breakdown characteristics. Accordingly, the concentrations of the alloy components are indeed critical to the presently claimed invention, thus rebutting any case of *prima facie* obviousness.

e. Unexpected Results Exhibited by Appellant's Invention Rebut Any *Prima Facie* Case of Obviousness

A *prima facie* case of obviousness may be overcome by demonstrating that the claimed invention exhibits unexpected results (MPEP § 716). JP '724 teaches in ¶ [0004] that it is "required" and a "necessary condition" of the alloy that it has a narrow liquid-solid coexistence range, so that the dispersion of the working temperature range of the thermal fuse will be small and the thermal fuse can work at a predetermined temperature. Based on JP '724, it would thus have been expected that an alloy having a wide solid-liquid coexistence region would have exhibited undesirable properties, that is, a wide dispersion of the working temperature ranges of the thermal fuse and an inability to work at a predetermined temperature.

To the contrary, while the alloys according to the present invention have a wide solid-liquid coexistence region, thermal fuses formed from such alloys have a narrow dispersion of operating temperature range of only $\pm 5^{\circ}\text{C}$ (Spec., ¶ [0026]) and work at predetermined temperatures. In fact, exemplary thermal fuses prepared according to the present invention (Examples 1-15 of Appellant's Specification) exhibit operating temperature dispersions of as low

as $\pm 2^{\circ}\text{C}$, and no higher than 5°C . These properties would not have been expected based on JP ‘724 and are indicative of non-obviousness.

It would also not have been expected based on JP ‘724, which teaches away from a wide solid-liquid coexistence region, that thermal fuses prepared from alloys according to the invention would not exhibit physical destruction, such as crack generation due to local and sudden internal pressure rise, or reconnection between charred flux portions, during operation. This destruction, which leads to dielectric breakdown, occurs in fuses prepared from alloys with a narrow solid-liquid coexistence region. Thus, the presence of unexpected properties has been demonstrated.

JP ‘724 also teaches (¶ [0013]) that when the concentration of Bi in the ternary alloy is less than 7%, it becomes difficult to draw the alloy into a thin wire having a diameter of 350 $\mu\text{m}\phi$, due to improper ductility. However, as described in Examples 6-9 of Appellant’s Specification, a variety of Sn-In-Bi alloys were prepared which contained only 1% Bi (less than 7% Bi), and all were found to exhibit good wire drawability, that is, the ability to be drawn into a wire having a diameter of 300 $\mu\text{m}\phi$ with no breakage. The drawability of alloys containing less than 7% Bi would not have been expected based on JP ‘724. Thus, the presence of an unexpected property, which is evidence of non-obviousness, has been demonstrated and rebuts any case of *prima facie* obviousness.

B. The Rejection of Claims 11-18 Under 35 U.S.C. § 103(a) as being unpatentable over JP ‘724 in view of JP 40-3110732 (“JP ‘732”) is Improper.

1. Disclosure of JP ‘732

JP ‘732 teaches a method for preventing flux from adhering to the end of an insulating tube in an alloy temperature fuse by controlling the radius of a disc portion of the thermal fuse. JP ‘732 discloses that disc portions are provided at ends of opposite lead wires, and that each disc portion has a specific radius. Such an alloy temperature fuse allegedly prevents flux from adhering to the end of an insulating tube, provides sealing of the sealing portion, and allows for quick spherical separation.

2. The Examiner’s Position

In the September 27, 2006 Office Action, the Examiner argues that JP ‘724 teaches that lead conductors are bonded to ends of the fuse element, respectively, a flux is applied to the fuse

2. Examiner's Position

In the September 27, 2006 Office Action, the Examiner acknowledges that the proposed combination of JP '724 and JP '732 does not teach or suggest providing a heating element for fusing off the fuse element. However, GB '608 allegedly teaches providing a resistor to blow a thermal fuse in order to terminate heating in a heating circuit of an electric blanket. Therefore, the Examiner concludes that it would have been obvious to modify the JP '724/JP '732 combination by providing a resistor to blow a thermal fuse in order to terminate heating in a heating circuit for an electric blanket, as taught by GB '608.

3. Appellant's Position

a. There Would Have Been No Motivation to Combine JP '724, JP '732 and GB '608

As described in Sections VII.A.1. and VII.B.1. above, JP '724 and JP '732 are both directed to alloy thermal fuses. In contrast, GB '608 teaches a heating circuit for an electric blanket which contains a resistor to blow a thermal fuse upon overheating of the heating circuit. There would have been no motivation to modify the proposed JP '724/JP '732 thermal fuse by providing a resistor which is taught to terminate heating in a heating circuit for an electric blanket as taught by GB '608.

b. The Proposed Combination of JP '724, JP '732, and GB '608 Would Not Teach or Suggest the Claimed Elements

As set forth in Section VII.B.3.a., no *prima facie* case of obviousness has been established based on the proposed combination of JP '724 and JP '732, since even the proposed combination would not teach or suggest the presently claimed alloy composition nor the results exhibited by the presently claimed alloy thermal fuse. Further, even the proposed combination with GB '608 would not cure the deficiencies with the JP '724/JP '732 combination. GB '608 does not teach or suggest alloy type thermal fuses, and thus does not teach or suggest the claimed alloy composition, nor would the results exhibited by the presently claimed invention have been expected based on the combination of JP '724, JP '732, and GB '608.

VIII. CONCLUSION

For the reasons set forth above, Appellant respectfully submits that the Examiner's rejection is improper. Appellant respectfully requests consideration of the above arguments by the Honorable Board, and reversal of the Examiner on all grounds of rejection.

Respectfully submitted,

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October 25, 2007

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Attachments: Appendix A: Claims Appendix
Appendix B: Evidence Appendix
Appendix C: Related Appeals and Interferences Appendix

APPENDIX A: CLAIMS APPENDIX

3. An alloy type thermal fuse comprising a thermal fuse element having an alloy composition in which Sn is greater than 46 weight % and less than or equal to 70 weight %, Bi is at least 1 weight % and less than or equal to 12 weight %, and In is at least 18 weight % and less than 48 weight %, and wherein the composition does not intentionally contain an element whose use is prohibited due to its harmful effects on a living body.

4. An alloy type thermal fuse comprising a thermal fuse element wherein 0.1 to 3.5 weight parts of one, two or more elements selected from the group consisting of Ag, Au, Cu, Ni, Pd, Pt, Sb, Ga, and Ge are added to 100 weight parts of an alloy composition in which Sn is greater than 46 weight % and less than or equal to 70 weight %, Bi is at least 1 weight % and less than or equal to 12 weight %, and In is at least 18 weight % and less than 48 weight %, and wherein the composition does not intentionally contain an element whose use is prohibited due to its harmful effects on a living body.

5. An alloy type thermal fuse according to claim 3, wherein said fuse element contains inevitable impurities.

6. An alloy type thermal fuse according to claim 4, wherein said fuse element contains inevitable impurities.

7. An alloy type thermal fuse according to claim 3, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

8. An alloy type thermal fuse according to claim 4, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

9. An alloy type thermal fuse according to claim 5, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

10. An alloy type thermal fuse according to claim 6, wherein said fuse element is connected between lead conductors, and at least a portion of each of said lead conductors which is bonded to said fuse element is covered with an Sn or Ag film.

11. An alloy type thermal fuse according to claim 3, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

12. An alloy type thermal fuse according to claim 4, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

13. An alloy type thermal fuse according to claim 5, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

14. An alloy type thermal fuse according to claim 6, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and

said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

15. An alloy type thermal fuse according to claim 7, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

16. An alloy type thermal fuse according to claim 8, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

17. An alloy type thermal fuse according to claim 9, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

18. An alloy type thermal fuse according to claim 10, wherein lead conductors are bonded to ends of said fuse element, respectively, a flux is applied to said fuse element, said flux-applied fuse element is passed through a cylindrical case, gaps between ends of said cylindrical case and said lead conductors are sealingly closed, ends of said lead conductors have a disk-like shape, and ends of said fuse element are bonded to front faces of said disks.

23. An alloy type thermal fuse according to claim 3, wherein a heating element for fusing off said fuse element is additionally disposed.

24. An alloy type thermal fuse according to claim 4, wherein a heating element for fusing off said fuse element is additionally disposed.

25. An alloy type thermal fuse according to claim 5, wherein a heating element for fusing off said fuse element is additionally disposed.

26. An alloy type thermal fuse according to claim 6, wherein a heating element for fusing off said fuse element is additionally disposed.

27. An alloy type thermal fuse according to claim 7, wherein a heating element for fusing off said fuse element is additionally disposed.

28. An alloy type thermal fuse according to claim 8, wherein a heating element for fusing off said fuse element is additionally disposed.

29. An alloy type thermal fuse according to claim 9, wherein a heating element for fusing off said fuse element is additionally disposed.

30. An alloy type thermal fuse according to claim 10, wherein a heating element for fusing off said fuse element is additionally disposed.

31. An alloy type thermal fuse according to claim 11, wherein a heating element for fusing off said fuse element is additionally disposed.

32. An alloy type thermal fuse according to claim 12, wherein a heating element for fusing off said fuse element is additionally disposed.

33. An alloy type thermal fuse according to claim 13, wherein a heating element for fusing off said fuse element is additionally disposed.

34. An alloy type thermal fuse according to claim 14, wherein a heating element for fusing off said fuse element is additionally disposed.

35. An alloy type thermal fuse according to claim 15, wherein a heating element for fusing off said fuse element is additionally disposed.

36. An alloy type thermal fuse according to claim 16, wherein a heating element for fusing off said fuse element is additionally disposed.

37. An alloy type thermal fuse according to claim 17, wherein a heating element for fusing off said fuse element is additionally disposed.

38. An alloy type thermal fuse according to claim 18, wherein a heating element for fusing off said fuse element is additionally disposed.

APPENDIX B: EVIDENCE APPENDIX

The Liquidus Projection Diagram was filed as Appendix I with the Request for Reconsideration on December 21, 2006, and entered by the Examiner.

APPENDIX C: RELATED APPEALS AND INTERFERENCES APPENDIX

None.